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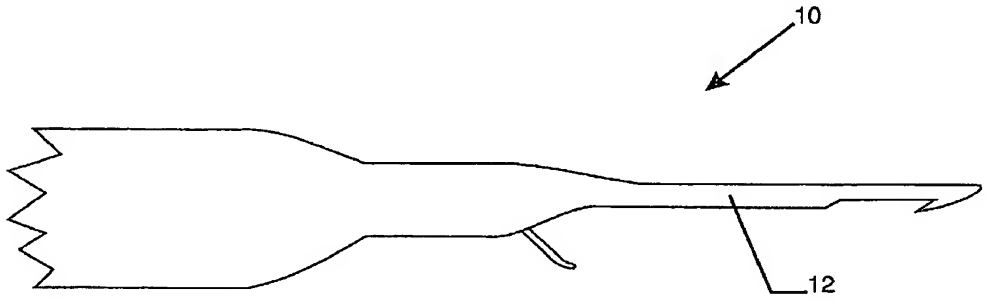
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: COATED RAPIER



(57) Abstract: The invention relates to a rapier coated at least partially with a hard metal based coating, said coating having a hardness higher than 1000 Vickers. Possibly, the rapier is further coated with a hard carbon coating on top of this hard metal based coating. The invention further relates to a method of manufacturing a coated rapier.

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Coated rapier.

Field of the invention.

The invention relates to a rapier coated with a hard metal based coating and to a method of manufacturing such a coated rapier.

Background of the invention.

In a weaving machine, a rapier is used for the picking of a thread across the width of the weaving machine.
The portions of the rapier coming into sliding contact with the treads suffer from frictional abrasion by the threads.

Summary of the invention.

It is an object of the present invention to provide a rapier with a high wear resistance and an improved durability.

According to a first aspect of the present invention, a rapier coated at least partially with a hard metal based coating is provided. The hard metal based coating has a hardness higher than 1000 Vickers. More preferably, the hard metal based coating has a hardness higher than 1200 Vickers or higher than 1400 Vickers.

Hard metal based coatings comprise for example metal carbides, metal nitrides and metal oxides, such as tungsten carbide, titanium carbide, chrome nitride, aluminium oxide, chrome oxide, ...

Hard metal based coating according to the invention can be deposited by any technique known in the art. However, the hard metal based coating is preferably deposited by thermal spraying.
Thermal sprayed coatings are characterised by a surface roughness Ra between 2 and 5 µm.
The term Ra is defined as the arithmetical mean deviation of the profile.

The hard metal based coating preferably has a thickness ranging between 10 and 500 µm. More preferably, the hard metal based coating has a thickness between 30 and 200 µm, as for example 100 µm.

In a preferred embodiment the hard metal based coating is further coated with a hard carbon coating on top of the hard metal based coating.

Preferred hard carbon coatings comprise diamond-like coatings.

Diamond-like coating are amorphous carbon based coatings with a high hardness and a low coefficient of friction. Their unique composition and structure results in excellent wear resistance and non-sticking characteristics.

Diamond-like coatings comprise for example diamond-like carbon (DLC) coatings and diamond-like nanocomposite (DLN) coatings or layered structures of diamond-like carbon (DLC) and diamond-like nanocomposite (DLN) coatings.

Diamond-like coating comprise for example diamond-like carbon (DLC) coatings and diamond-like nanocomposite (DLN) coatings.

Diamond-like carbon coatings comprise amorphous hydrogenated carbon coatings (a-C:H); whereas diamond-like nanocomposite coatings comprise interpenetrating networks of a-C:H and a-Si:O. A representative DLN coating comprises 30 to 70 at% C, 20 to 40 at% H, 5 to 15 at% Si and 5 to 15 % O.

DLN coatings exhibit a very low coefficient of friction, even in high humidity or wet environment.

To influence its conductivity, the DLC or DLN coating can further be doped with a transition metal. In particular W, Zr Ti, Nb and Ta are well suited as doping elements.

The DLC or DLN coating can further contain an inert gas such as Ne, Ar or Kr, for example in an amount of 0.5 to 5 at%.

According to a second aspect of the present invention, a method of manufacturing a rapier is provided.

The method comprises the steps of

- providing a rapier;
- applying a hard metal based coating by thermal spraying.

To obtain a good adhesion, before the application of the hard metal based coating, the substrate is preferably pretreated by any technique known in the art as for example by grit blasting, grinding, milling, polishing or by a combination of these techniques.

A preferred method further comprises the step of

- applying a hard carbon coating.

The hard carbon coating such as a DLC or DLN coating is preferably applied by chemical vapour deposition.

It can be preferred to pretreat the rapier coated with the hard metal based coating before the application of the hard carbon coating.

This pretreatment may comprise for example grit blasting, grinding, milling, polishing or a combination of these techniques.

According to a third aspect of the invention a method to reduce the number of yarn ruptures during weaving is provided. The number of yarn ruptures is decreased by using a rapier as described above.

Brief description of the drawings.

The invention will now be described into more detail with reference to the accompanying drawings wherein

- Figure 1 is a coated rapier according to the present invention.

Description of the preferred embodiments of the invention.

A rapier 10 according to the present invention is shown in figure 1.
The surface of the rapier 12 susceptible to wear due to the contact with the treads or yarn of the weaving machine of the rapier is coated with a thermal sprayed coating WC coating.
Before the application of the thermal sprayed coating, the rapier is pretreated by milling and polishing the surface to be coated.
In a next step a DLN coating is applied by chemical vapour deposition.

The WC coating has a thickness of 100 µm and a hardness of 1400 Vickers.
The WC coating has a roughness Ra of 4 µm.
Before the application of the DLN coating the rapier may be subjected to a milling an polishing operation until a surface roughness of 0.4 or 0.1 µm.

Wear on the rapier is strongly reduced because of the high wear resistance of the thermal sprayed hard metal based coating.
The low friction properties of the DLN coating reduce the number of yarn ruptures.

The life-time of a coated rapier according to the present invention is compared with the life-time of a rapiers known in the art such as rapiers coated with a hard chrome coating or rapiers coated with a polymer coating. It has been shown that the life-time of a rapier according to the present invention is at least 2 till 3 times longer than the life-time of the rapiers known in the art.

CLAIMS

1. A rapier coated at least partially with a hard metal based coating, said coating having a hardness higher than 1000 Vickers.

2. A rapier according to claim 1, whereby said hard metal based coating is deposited by thermal spraying.

3. A rapier according to claim 1 or 2, whereby said hard metal based coating has a surface roughness Ra between 2 and 5 µm.

4. A rapier according to any one of the preceding claims, whereby said rapier is further coated with a hard carbon coating on top of said hard metal based coating.

5. A rapier according to any one of the preceding claims, whereby said hard carbon coating comprises a diamond-like carbon coating.

6. A rapier according to any one of claims 1 to 4, whereby said hard carbon coating comprises a diamond-like nanocomposite coating.

7. A method of manufacturing a coated rapier, said method comprising the steps of
   - providing a rapier;
   - applying a hard metal based coating by thermal spraying.

8. A method according to claim 6, further comprising the step of
   - applying a hard carbon coating.

9. A method according to claim 8, whereby said hard carbon coating is applied by chemical vapour deposition.

10. A method to reduce the number of yarn ruptures during weaving by using a rapier as claimed in claim 1 to 6.

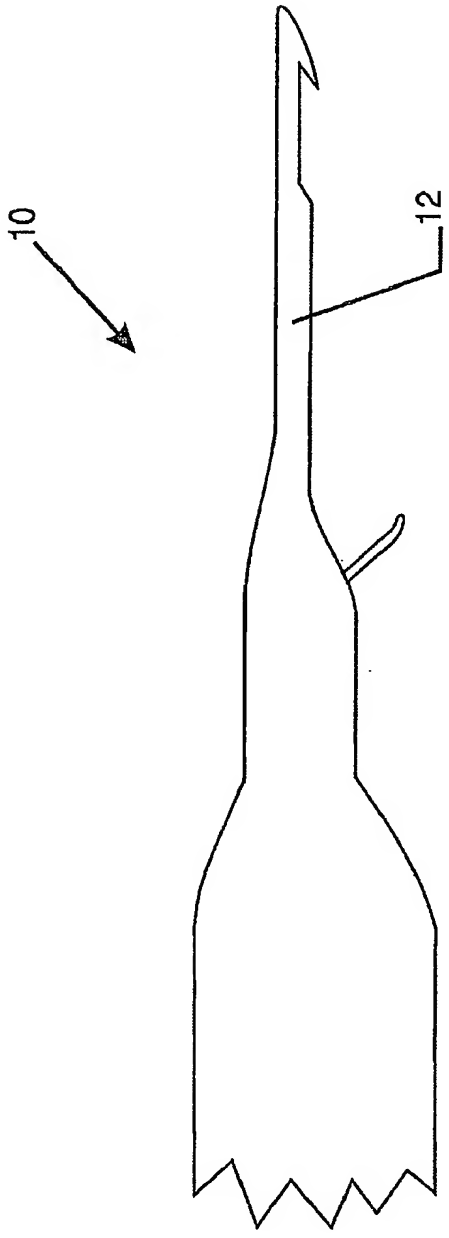

Fig. 1

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D03D47/23 D03D47/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
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